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an equatorial belonging to the Harvard College Observatory, and *twenty* cameras are also provided for photography.

It is to be hoped that the expedition will meet with fine weather, in order to utilize its unusually large force of observers and instruments. Sir ISAAC NEWTON said at the death of his pupil COTES, "If COTES had lived, we should have known something." If the four minutes of totality are clear at St. Paul de Loando we shall certainly learn something from these many skilled observers with their large equipment.

It now appears that with two expeditions in Africa, and with two at least, in America, the observation of this eclipse is thoroughly well provided for. It should be a source of gratification to Californians, and especially to this Society, that the generosity of one of our members has allowed the Lick Observatory to put a strong expedition in the field.

E. S. H.

October 26, 1889.

ECLIPSE OF *JAPETUS*, THE VIII SATELLITE OF *SATURN*, ON NOVEMBER 1, 1889.

The eclipse of *Japetus* was observed here on November 1 with the twelve-inch equatorial. Only a part of this very rare phenomenon was visible at this point, the interval between the rising of *Saturn* and daylight covering only a small portion of the time occupied by the eclipse, or, rather, series of eclipses; for the satellite passed through the shadow of the entire ring system as well as that of the globe of *Saturn*. The satellite would first pass into the outer edge of the shadow of the ring, and would next appear in the sunlight, shining through the CASSINI division, being visible for probably eighteen minutes. It would then pass into the shadow of the inner bright ring; from this it would emerge in the semi-shadow of the Crape Ring, from which it would pass into the sunlight again between the shadow of the Crape Ring and that of the ball. It would next enter the shadow of the ball, and, from this point on, a reversal of all the first phenomena would happen. The entire series of eclipses covered a period of approximately nineteen hours. That portion of the eclipse which could be seen from the Lick Observatory was the reappearance from the shadow of the globe and passage through the semi-shadow of the Crape Ring into the shadow of the inner bright ring.

The important questions in connection with this phenomenon

were: Would the satellite become visible when it came to the projection of the CASSINI division? What would be the effect of the Crape Ring upon the appearance of the satellite?

The last question only could be answered from this point, as the satellite would rise eclipsed in the shadow of the ball, and not reach the second part of the CASSINI division until long after sun-up.

Carefully watching the point of reappearance of the satellite, it was faintly caught at $14^h 38^m$ Mt. H. m. t. It reappeared quite close to the satellites *Tethys* and *Enceladus*. It grew pretty rapidly brighter, and attained its full brightness at about $14^h 50^m$. It was then about 0.1 magnitude less than *Tethys*. The proximity to these two satellites gave an excellent means of detecting changes in its brightness by comparison with their light. Eighty such comparisons were made, and from these I have constructed a curve, which very clearly shows what effect the Crape Ring had upon the appearance of the satellite. *Japetus* required a little over ten minutes to become wholly free from the shadow of the ball. After remaining at its full brightness for fifteen minutes, it began very slowly to decrease in light; however, changing less than 0.1 magnitude in forty minutes' time. At $15^h 54^m$ the light began to decrease more rapidly, and in sixty-five minutes it passed through 0.7 of a magnitude. It then approached the shadow of the inner bright ring, and in fifteen minutes its light diminished 0.66 of a magnitude, when it totally disappeared, at $17^h 11^m \frac{1}{2}$.

These observations show us that, after striking the sunlight shining through between the ball and the rings, the satellite then passed into the shadow of the Crape Ring, which sensibly affected its brightness. Passing deeper into this *shade*, the absorption of the sunlight became more and more pronounced, until finally the satellite struck the shadow of the inner bright ring, which it rapidly entered and within which it disappeared.

These observations, therefore, tell us that the Crape Ring is truly transparent—the sunlight sifting through it; that the particles composing the Crape Ring cut off an appreciable quantity of sunlight; that these particles cluster more and more thickly—or, in other words, the Crape Ring is denser as it approaches the bright rings.

Observations made elsewhere will tell us whether the satellite was seen when it entered the projection of the CASSINI division. The observations will be published in full in the *Monthly Notices* of the Royal Astronomical Society.

E. E. B.

MT. HAMILTON, Nov. 6th, 1889.

 PARABOLIC ELEMENTS OF COMET SWIFT (Nov. 16).

 BY A. O. LEUSCHNER.

From the three successive observations at Lick Observatory, November 20, 21, 22, which were kindly communicated to me by Professor E. E. BARNARD, I have deduced the following parabolic elements by OPPOLZER's method:

$$T = 1889, \text{ Dec. 11, 8493 G. M. T.}$$

$$\Omega = 306^\circ 25'$$

$$\omega = 116^\circ 24' \quad O - C \quad \begin{cases} d\lambda, \cos \beta = +1'.2 \\ d\beta = \pm 0.0 \end{cases}$$

$$i = 6^\circ 47'$$

$$\log q = 0.0633$$

The small geocentric arc and the error of 1'.2 remaining in λ render these elements extremely uncertain. The comet is very likely periodic.

BERKELEY, CAL., November 27, 1889.

MINUTES OF THE MEETING OF THE BOARD OF DIRECTORS, HELD
 NOVEMBER 30, 1889, AT 408 CALIFORNIA STREET,
 SAN FRANCISCO.

A quorum was present.

The minutes of the last meeting were read and approved.

Bills presented by the Secretary and Treasurer were approved.

Miss C. W. BRUCE, of New York City, was duly elected a life member, subject to the action of the Society.

Adjourned.

MINUTES OF THE MEETING OF THE ASTRONOMICAL SOCIETY OF
 THE PACIFIC, HELD NOVEMBER 30, 1889 (BY INVITATION),
 IN THE ROOMS OF THE CALIFORNIA ACADEMY
 OF SCIENCES, SAN FRANCISCO.

[PREPARED BY THE SECRETARIES FOR PUBLICATION.]

Owing to the absence of the President, Vice-President PIERSON took the chair.

The thanks of the Society were tendered to the California Academy of Sciences for the use of their rooms.

The minutes of the last meeting were read and approved.

A list of gifts to the Society was read, and thanks were returned to the donors.